

# THE MINERAL INDUSTRY OF BOLIVIA

By Steven T. Anderson

## Introduction

The mineral industry has a long history in the Republic of Bolivia, where the country has been a globally significant producer of antimony, cadmium, gold, lead, silver, tin, tungsten, and zinc. In the mid-1980s, however, international tin prices decreased precipitously, and the prices of Bolivia's other important metal export commodities also declined. Natural gas replaced combined metals and industrial minerals as the country's leading export, and promoting natural gas exports has been the focus of the Bolivian Government's economic development strategy since the late 1980s. This strategy proved to be very lucrative, and the natural gas sector attracted substantial foreign direct investment (FDI) in the late 1990s. Using the gains from this sector of the mineral industry to achieve economic development has been problematic in several aspects. The operation of Bolivia's network of natural gas pipelines employs very few people (even relative to other capital-intensive mining projects), the natural gas export revenue has gone mostly to foreign investors, and an inefficient taxation and redistribution scheme has been problematic to enforce. Additionally, the pipelines were designed almost exclusively for natural gas export, so most Bolivians do not have direct access to this energy resource and can benefit only from redistribution of tax revenue from the pipelines (Economist, The, 2005; Federal Research Division, U.S. Library of Congress, 1989§<sup>1</sup>).

In 2004, Bolivia mined, in decreasing order of value, tin, zinc, gold, silver, lead, antimony, and tungsten. Although the mining industry dominated the Bolivian economy from colonial times through 1985, Bolivia was still estimated to have substantial untapped resources of antimony, gold, iron ore, lead, lithium, silver, tin, and zinc. The few smelting and refining facilities that existed in Bolivia have reportedly not been well maintained since their initial construction, and the historical practice of exporting mineral raw materials overseas to be further processed remained the model for mineral exploitation in the country in 2004 (Monahan, 2004§).

Despite significantly higher annual average prices for most metals and some industrial minerals, the value of production of the mining and mineral processing sector contributed about 3.8% of the value of the real gross domestic product (GDP) in Bolivia in 2004 compared with 6.1% in 1995. The value of production of mineral fuels (predominantly natural gas) contributed about 6.1% of the value of the real GDP in 2004 compared with only 4.1% in 1995 (Instituto Nacional de Estadística, 2005a, p. 397). Bolivia's GDP based on purchasing power parity was \$24.14 billion in 2004, which amounted to an increase of 6.2% compared with that of 2003. In 2004, inflation grew by about 4.4% compared with that of 2003 (International Monetary Fund, 2005§).

In 2004, exports of mineral fuels accounted for about 38% of total exports and 9.6% of the nominal GDP compared with about 30% and 6.2%, respectively, in 2003. The nominal value of natural gas exports accounted for 73% of the value of all exports of mineral fuels in 2004 compared with 77% in 2003 owing to the increase in the price of petroleum relative to that of natural gas during the same timeframe. Exports of other minerals, mostly in the form of ores and concentrates, accounted for about 20% of total exports and 5.2% of the nominal GDP. Since 1995, annual exports of zinc have dominated the Bolivian nonfuel mineral export market, although exports of gold also enjoyed a prominent role until 2004. In 2004, the international market for tin improved dramatically and Bolivian exports of tin almost doubled in nominal value compared with that of 2003. This allowed tin to replace gold as the second ranked nonfuel mineral export behind zinc for the first time since 1995. Silver was the third ranked nonfuel mineral export in 2004, and the value of Bolivian silver exports increased by slightly more than 20% compared with that of 2003 owing to higher silver prices and increased production at silver mines that had reduced production during the recent period of low prices. Mine production of metals and production of industrial minerals accounted for about one-fourth of Bolivia's foreign exchange in 2004 (U.S. Commercial Service, 2004, p. 10; Instituto Nacional de Estadística, 2005a, p. 523; International Monetary Fund, 2005§).

At the beginning of 2004, Bolivia's proven reserves of natural gas were second only to Venezuela in South America, but were also only slightly greater than those of Trinidad and Tobago and Argentina in Latin America. Bolivia's resources provide the potential for it to become a hub for trade of mineral fuels in South America, however, given its own natural gas production capacity, its network of pipelines, and its strategic location in the center of the continent next to Chile, which is becoming increasingly dependent on imports of natural gas. Bolivia's reserves of petroleum are currently much less significant than the country's natural gas reserves. Bolivian copper, gold, iron ore, silver, tin, and zinc resources have been estimated to be globally significant, but accurate figures concerning the country's leading mineral resources are mostly unavailable. Ten percent of the most readily accessible mineral wealth of Bolivia is thought to have been exploited, but domestic mining interests have not yet engaged in sufficient exploration to define the extent of these mineral deposits completely. In addition, foreign investment in exploration has been frequently deterred by uncertainty concerning taxation and rights to exploit existing reserves and by civil unrest, including participation in anti-foreign investment demonstrations by cooperative miners. In 2004, the primary minerals of interest for exploration and development of production in Bolivia were antimony, boron materials, copper, gold, lead, lithium, potassium, nickel, semiprecious stones, silver, sulfur, tin, and zinc (U.S. Commercial Service, 2004, p. 4, 10, 18; Economist, The, 2005; Amcham Bolivia, 2005§).

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<sup>1</sup>References that include a section mark (§) are found in the Internet References Cited section.

## Government Policies and Programs

Once established, mining operations have been quite profitable owing to resource quality and lower labor costs (even relative to neighboring countries), but Bolivia's geographic location and lack of access to the ocean have resulted in higher costs of importing materials and equipment into the country and exporting mineral products to more lucrative markets outside of its immediate neighbors. Historically, these structural conditions of the mineral industry have led to a focus on predominantly producing just one or two mineral commodities that have the highest export value in any given year. In addition, the political risk of developing mineral fuels resources has grown in recent years for both mining ventures and projects, which has reduced investment in new mineral production projects that could contribute to greater diversity in production and less relative price risks in the mineral industry of Bolivia. The institutional characteristics of the Bolivian economy that annually define the high (again, relative to neighboring countries) level of political risk include a lack of judicial security, alleged corruption among public officials, frequent episodes of social unrest, arbitrary decisions by regulators and Government officials, cumbersome bureaucratic procedures, and political pressure to abrogate contracts (U.S. Commercial Service, 2004, p. 2; International Monetary Fund, 2005, p. 14).

In 2004, the Bolivian Government debated modifications to the Hydrocarbons Law that had been in place since 1996 and had been successful in attracting substantial FDI to this vital sector of the country's mineral industry and economy. Many companies that were already deeply invested in natural gas pipelines and other development projects in Bolivia were very concerned that significant changes to this law would jeopardize their control over current installations and deter further investment (U.S. Commercial Service, 2004, p. 2; International Monetary Fund, 2005, p. 14). The 1996 law laid out a very clear policy for taxation of both production and exports of mineral fuels, and there have been consistent Government policies to use natural gas export tax revenue to subsidize domestic energy consumption (including for mineral ore concentrating, refining, smelting, and other processing). The implementation of these taxation and redistribution policies was inconsistent, however. In 2004, this became an especially important issue, with fuel prices increasing and the Government actually reducing subsidies of domestically consumed mineral fuels (Economist, The, 2005).

The potentially lax enforcement of tax laws was only one of the reasons why FDI flows into the natural gas sector of Bolivia had increased since 1996. Another reason was that the role of the state-run mineral fuels company Yacimientos Petrolíferos Fiscales Bolivianos (YPFB) was altered to attract foreign investment (given Bolivia's limited domestic capacity to develop its own natural gas reserves). As a provision of the 1996 law, YPFB had new authority to enter into joint-venture contracts for an extended period of time (usually 40 years) with private companies. Thus, YPFB still retained its primary responsibility of administering permits for exploration and export agreements but was better able to allow foreign companies to take on the primary responsibility for actively developing wells and pipelines. In 2004, the most important export agreement administered by YPFB was a general sales agreement with Brazil's state-run oil company Petróleo Brasileiro S.A. (Petrobrás), which called for the sale of about 10 billion cubic meters per year of natural gas to Brazil from 1999 through 2019. This agreement was first approved in 1993. In 2004, Brazil was attempting to renegotiate this contract because its domestic market prices for electricity, including that proposed to be generated by new powerplants fueled by natural gas, fell dramatically after Brazil invested substantially in its hydropower capacity in 2002 and 2003. Also, Petrobrás expressed the belief that continuing imports of gas from Bolivia were depressing incentives for energy companies to develop Brazil's new gas reserves in the Santos Basin, which were discovered in 2002 (U.S. Commercial Service, 2004, p. 18; 2004§).

Many Bolivians demonstrated during 2004 for full renationalization of the mineral fuels sector, and some influential members of Congress proposed versions of a new Hydrocarbons Law that would result in almost full nationalization. In contrast, the Bolivian President's proposal was aimed at eliciting greater revenues from the established foreign private interests and improving the country's ability to consume more natural gas domestically. The President's proposed changes included incentives for foreign companies to shift investment from discovering new deposits or building more export pipelines to investing in such businesses as household gas connections and the conversion of some gasoline-powered vehicles to ones that run on compressed natural gas. The President's proposal still aimed to retain tax incentives for foreign investors to maintain a presence in the country and to continue some exploration and development efforts with respect to basic natural gas and petroleum production; the only new tax proposed by the President was an additional tax on the sales of private firms that own production and exportation facilities for mineral fuels in the country. Mostly, the President's proposal was focused on increasing enforcement of the tax provisions already included in the 1996 Hydrocarbons Law (U.S. Commercial Service, 2004, p. 18; Roque, 2005§).

The Bolivian Congress's proposals included the following components: increasing total taxation on production (royalty payments) to 50% (or higher) from the 2004 levels of about 18%, imposing state controls on free commercialization of natural gas products, imposing additional taxes on property where deposits of mineral fuels are located and foreign owned (regardless of productivity), and forcing migration of exploitation contracts from majority ownership by private foreign companies to at least majority ownership by YPFB. Members of Congress argued that the 1996 Hydrocarbons Law was less effective than expected in increasing profit-based and excise taxes and even lowered production taxes for new fields. The leading members of the Congress expressed serious doubts concerning the Government's ability to collect sufficient proportions of existing taxes or any additional taxes without majority ownership by YPFB (formal renationalization) of the mineral fuels sector (U.S. Commercial Service, 2004, p. 18; International Monetary Fund, 2005, p. 14).

With respect to the mining sector, the Government adopted a plan for reactivation that did not necessarily require renationalization. The reactivation plan was aimed at redirecting as much of expected increases in FDI in mining projects (primarily owing to expectations of continuing higher prices for most metals and industrial minerals) toward broader economic development efforts. After FDI in the mining sector increased somewhat in 2003 (following a historic low level in 2002), Bolivian expectations in 2004 were for FDI in mining projects to increase substantially through at least 2008. Since the late-1980s, however, FDI in the mineral industry of Bolivia has consistently fallen below Government expectations. The primary targets of mining investment in 2004 were restarts of mining projects that had been put on hold between 1995 and 2003, or earlier, and did not reflect a substantial increase in exploration

or development of new mines. The mining reactivation plan was also aimed at providing more technical assistance in an appropriate form to small-scale and artisanal miners, many of whom are from families that were formerly employed by Corporación Minera de Bolivia (COMIBOL) and still work deposits formerly mined by the state-run mining company. The new plan was also reported to include new incentives to encourage COMIBOL and Servicio Nacional de Geología y Minería (SERGEOMIN) to intensify their exploration efforts and identify new mineral reserves for exploitation both by foreign interests and domestic mining entities (Instituto Nacional de Estadística, 2005a, p. 601; Amcham Bolivia, 2005§; Roque, 2005§).

The 2004 mining reactivation plan supplemented but did not replace the 1997 Mining Law. The 1997 law authorized such state-owned corporations as COMIBOL to establish joint ventures with private companies and allowed foreign firms paying taxes in Bolivia to obtain foreign tax credits in their home countries. The Mining Law also allowed foreign firms to operate within 50 kilometers (km) of international borders through joint ventures or service contracts with COMIBOL, except firms based in the country adjacent to the affected border. Under this law and as stipulated by the Bolivian Constitution, most of the mines owned by COMIBOL cannot be purchased outright, but they can be operated by private operators in a joint venture or under a leasing contract with COMIBOL. In 2004, development of some of the potentially lucrative mining projects that were controlled by COMIBOL was still under review, and FDI was below the levels that were expected when the 1997 Mining Law was passed (U.S. Commercial Service, 2004, p. 19, 33-34).

The mining reactivation plan of 2004 included a provision for the reestablishment of the Ministerio de Minería y Metalurgia (MMM) as an independent Ministry of the Government with the new Minister enjoying full status in the Bolivian Presidential Cabinet. The MMM had previously been the Viceministerio de Minería y Metalurgia (VMM) under the Ministerio de Desarrollo Económico. In 2002, the VMM and the Viceministerio de Hidrocarburos (VMH), which were responsible for implementing most of the policies pertaining to the mineral industry of Bolivia, were reassigned to form the two main branches of a new Ministerio de Minería e Hidrocarburos (MMH). In 2004, a new Ministerio de Hidrocarburos y Energía (MHE) was formed when the VMM was separated from the MMH to form the MMM; the new MHE was focused on implementing the country's energy policies and policies pertaining to the mineral fuels sector of the mineral industry (Golden Eagle International Inc., 2004). Near the beginning of 2004, the former Vice Minister of Mining made contact with a diplomatic representative of the People's Republic of China to discuss possible Chinese provision of investment capital to help support the Government's plan to reactivate the mining sector of Bolivia (Ministerio de Hidrocarburos y Energía, Bolivia, 2005).

In 2004, foreign firms expressed reluctance concerning the probable costliness of certain popular (amongst Bolivians) provisions in the new mining reactivation plan. One of these provisions required foreign investors to contribute substantially to the economic development of the communities that are nearest to their proposed mining activities. Other popular requirements of the plan were that a minimum number of Bolivians be employed in all stages of exploration, development, and exploitation of new mineral deposits; that mining firms use Bolivian utility and construction contractors for any planned enhancements to infrastructure; that more capacity be installed for advanced mineral processing and to enable Bolivia to produce more finished products; and that mining firms cooperate with any nearby cooperatives of artisanal miners to work the mines and transfer skills and technology (Roque, 2005§).

Part of the risk to foreign firms of investing in the mineral industry of Bolivia is the risk of expropriation by the Bolivian Government, either directly, through COMIBOL, or via some other state-run entity, such as YPFB. Article 22 of the Bolivian Constitution provides that property may be expropriated for the public good or when the property does not fulfill a social purpose. It also stipulates that just compensation must be provided. Both the Mining and Hydrocarbons Laws provide the means to expropriate land needed to develop the underlying concession. In 2004, some critics of the proposed revisions to the Hydrocarbons Law were concerned that the revisions would strengthen the power of YPFB to expropriate natural gas properties that were controlled by foreign interests. Foreign firms expressed concerns that a new Hydrocarbons Law will pave the way to a renationalization of the mineral fuels sector in Bolivia and they cited historical examples, such as when the Bolivian Government nationalized petroleum concessions granted to a South American subsidiary of Gulf Oil in 1969 (U.S. Commercial Service, 2004, p. 35). Many historical examples of expropriation in the mining sector of Bolivia have not been forgotten by foreign investors either, such as U.S. Steel being forced to give up its operation of the Matilde zinc mine in 1971 (Flexner, 2000, p. 6).

For foreign mining companies, another concern is the support that the Bolivian Government repeatedly concedes to small-scale, cooperative, and artisanal (SMACA) miners (most of whom are former employees of COMIBOL or the family members of former employees who are now loosely organized into cooperatives). On April 9, 2004, COMIBOL awarded the Sejsani y Sora Sora areas of the Huanuni tin mine to the local Cooperativa Minera Multiactiva mining cooperative of about 500 artisanal miners after denying petitions by medium-scale Compañía Minera Colquiri S.A. (CMC), which was a joint venture between Compañía Minera del Sur S.A. (COMSUR) of Bolivia (51%) and Actis Capital LLP of London, United Kingdom (49%), to operate the mine. This Government action followed demonstrations and roadblocks by these miners and other grassroots political interest groups that have become progressively more opposed to foreign ownership of natural resources, including deposits of metallic minerals, industrial minerals, and mineral fuels, since the late 1980s. In 2003, the Huanuni tin mine was reacquired by COMIBOL, as allowed under the Bolivian Constitution for any property formerly owned by COMIBOL that subsequently comes under legal dispute with respect to ownership or operational rights. CMC originally agreed to purchase the Huanuni Mine from RBG Resources plc, of London, United Kingdom. In 2002, however, COMIBOL disputed the sale after accounting discrepancies discovered at RBG required RBG to divest itself of many assets to meet its financial obligations. RBG acquired Huanuni from COMIBOL in 1999 as part of the long (and often reversible) process of privatization of COMIBOL's productive mining and smelting activities (Ministerio de Hidrocarburos y Energía, Bolivia, 2005).

The two main financial support agencies for small-scale and artisanal mining in Bolivia were La Fundación Medio Ambiente, Minería e Industria (MEDMIN) and El Proyecto del Apoyo a la Pequeña Explotación Minera. These agencies provided credit, financial support, and some technical support. They also helped small-scale miners and mining cooperatives register their concessions

and comply with national environmental regulations and other regulations. Since the mid-1990s, these agencies have approved credit for only 16 small-scale mining projects and they have actually disbursed only \$51,500 in funds to be allocated across 14 of those projects. Although quantitatively small by U.S. standards, at least 50% of this credit was still expected to enter default (Hentschel, Hruschka, and Priester, 2003, p. 58; Federal Research Division, U.S. Library of Congress, 1989§; Portal Minero, 2004b§)

## Structure of the Mineral Industry

Since the Bolivian Government procured loans to stabilize its finances following a sharp decrease in the price of tin in the mid-1980s, international lenders have encouraged the Government to progressively privatize the productive mining, smelting, and refining operations of COMIBOL, which has left COMIBOL with no day-to-day operational management or control of most of its former mineral properties. In the late 1980s, COMIBOL laid off 20,000 of its 27,000 employees; its remaining employees managed COMIBOL as a state-run holding company for mining and mineral processing properties. In 2004, COMIBOL was the Government entity that held the title to the land and underground mineral resources or simply to the land upon which a smelting complex may be located. Only the productive operations of the mines and smelters were privatized. COMIBOL awarded most of its former mining concessions and smelting operations as part of joint-venture contracts that stipulated how much the private companies would be required to reinvest in the mines and/or smelters and what percentage of revenue from any productive operations were to be paid as royalties to the Bolivian Government through COMIBOL among other, less important terms of the agreements (Barrau and others, 2004, p. 4; U.S. Commercial Service, 2004, p. 19, 34).

Many miners that were formerly employed by COMIBOL before its privatization actively participated in demonstrations and road blocks to protest against private mining companies that had been awarded mining or smelting contracts by COMIBOL. COMIBOL allowed its former employees and their families to continue to work old COMIBOL mines as cooperatives or as individuals and to use the mining machinery already present in those old mines as well as they could. By 2004, much of this technology was outdated, however, and much of it was not designed for use by an individual or a small group of miners. Also, there were repeated instances in which local miners clashed with mining companies that both claimed to have rights granted by COMIBOL to exploit a particular mine (Barrau and others, 2004, p. 5; U.S. Commercial Service, 2004, p. 18, 34; Bocangel, 2001§).

The privatization of state-run oil and gas company YPFB was similar to that of COMIBOL. The Government required YPFB to lay off only about one-third of its employees, however, because YPFB retained a significant role in exploration, development, and negotiating the terms of trade agreements for the export of mineral fuels, mostly natural gas, following privatization of its production operations. YPFB was never a significant employer in Bolivia, and most of its employees were not employed in the production portions of the company at the time that they were privatized. Thus, this limited privatization of YPFB did not cause as much of a public protest as that of COMIBOL (U.S. Commercial Service, 2004, p. 18, 34).

In 2004, the annual average price of tin was at its highest level since 1985, but Bolivia's tin exports were no longer able to compete effectively with low-cost alluvial tin from Indonesia and Brazil or lower cost production of tin from lode deposits in China and Peru. During the 1990s, gold and silver production increased dramatically in Bolivia, but production of gold fell sharply in 2004 as a result of depletion of reserves at Kori Kollo. After production at Kori Kollo came fully onstream in the late 1980s and prior to its becoming a mature mine in 2002, Bolivia extracted and exported from about 11,800 kilograms per year (kg/yr) to 14,500 kg/yr of gold and about 460 metric tons per year (t/yr) of silver. Additionally, Bolivia has increased its zinc production over the past 10 years, extracting from about 142,000 t/yr to 155,000 t/yr from 1995 through 2004. In 2004, the Government expected silver to be the leading metallic mineral export by 2007, but expectations concerning future gold production were more uncertain as exploration efforts had not resulted in discovery of another gold deposit as significant as Kori Kollo. The Government also expected Bolivia to begin producing iron ore and to increase production of tin and zinc to levels that would double the value of the country's production and exports of metals by 2008 (Federal Research Division, U.S. Library of Congress, 2005, p. 10-11; 1989§; Instituto Nacional de Estadística, 2005a, p. 469; Portal Minero, 2005§; Roque, 2005§).

In 2004, the modern metal mining sector in Bolivia consisted of 11 medium-scale mining companies affiliated through the Asociación Nacional de Mineros Medianos (ANMM), some of which did not produce in 2004. Together, these companies employed 4,039 people, including administrative staff, executives, mine workers, and technicians. The company membership in ANMM remained basically the same in 2004 as it was in 2003 except that Empresa Minera Himalaya S.A., a tungsten producer that had halted production of tungsten since 1993, officially shut down. Tungsten has been mined only by small-scale mining operations and cooperatives since 1994 (Asociación Nacional de Mineros Medianos, 2005, p. 49, 59, 83).

In 2004, the leading mining company in Bolivia was COMSUR, and the company's principal mineral commodity was zinc in concentrate, although COMSUR was also the country's leading producer of lead and silver. COMSUR owned and operated about five mines in the Oruro and Potosi Departments. Glencore International AG, which was based in Switzerland, acquired COMSUR at the end of 2004, and thereby also acquired a share of the medium-scale tin and antimony smelting complex Empresa Metalúrgica de Vinto S.A. through COMSUR's majority interest in CMC. The country's leading medium-scale producer of gold was Empresa Minera Paititi S.A. at the Don Mario Mine, Chiquitos Province, Santa Cruz Department. Paititi was a subsidiary of Orvana Minerals Corporation of Toronto, Ontario, Canada. Empresa Minera Unificada S.A. (EMUSA) was the next most important medium-scale mining company and accounted for all of Bolivia's medium-scale mine production of antimony and copper. EMUSA was a privately owned Bolivian mining company that also mined some silver and zinc. Empresa Minera Inti Raymi S.A. was a medium-scale mining company that still produced some gold and silver at its plant associated with the closed Kori Kollo Mine. The material processed at the Kori Kollo facilities was mined at the Kori Chaca Mine that was located adjacent to Kori Kollo and included some tailings recovered from material left over from the Kori Kollo Mine. Inti Raymi was owned by Newmont Mining Corporation of Denver, Colorado (88%) and EMUSA (12%). Empresa Minera La Solución S.A. was the only other medium-scale mining company with

notable production in 2004. La Solución was a privately owned Bolivian mining company that produced minor amounts of lead, silver, and zinc (Asociación Nacional de Mineros Medianos, 2005, p. 18; Glencore International AG, 2005§; Newmont Mining Corporation, 2005§).

In 2004, SMACA miners were responsible for about 62% of the mine production of gold in Bolivia. Additionally, all mine production of bismuth and tungsten in the country was attributed to SMACA miners, as well as 84% of the antimony, 84% of the copper, 63% of the tin, 47% of the silver, 46% of the lead, and 25% of the zinc (Asociación Nacional de Mineros Medianos, 2005, p. 80-84). Most cooperatives were small and consisted of individual miners organized by mine or specific mineral. Most mining cooperatives in Bolivia used very little technology and relied on artisanal mining methods. Cooperatives were more involved in the production of base metals, and less-organized small-scale and individual miners in the country were mostly involved in alluvial gold mining. Mining cooperatives were loosely organized under the Federación Nacional de Cooperativas Mineras (FENCOMIN), which also helped represent them and manage their extensive claims. Many small-scale miners were previously employed by COMIBOL, but most of them had not been formally employed in mining since being laid off in the late 1980s. Small-scale miners who did not belong to a cooperative were associated under the Bolivian Government's Cámara Nacional de Minería (CANALMIN), but a great many more unassociated miners were estimated to be actively mining in the country (Federal Research Division, U.S. Library of Congress, 1989§; Portal Minero, 2004b§).

In 2004, the mineral fuels sector attracted about one-half of all FDI in Bolivia, even while there was heightened uncertainty concerning probable approval of a new Hydrocarbons Law. This political uncertainty concerning the Bolivian economy's leading sector can be held responsible for having reduced total FDI to about one-half of what it was in 2002. Among the leading investors in the mineral fuels sector were Petrobrás of Brazil, Repsol YPF S.A. of Spain, the BG Group Plc of the United Kingdom, and the Empresa Petrolera Chaco S.A. (Chaco), which was owned by Bolivian private interests (including pension funds for former employees of YPFB) (50%); BP p.l.c. of the United Kingdom (30%); and Bidas Corporation of Argentina (20%) (Instituto Nacional de Estadística, 2005a, p. 271; Amcham Bolivia, 2005§; BP p.l.c., 2006§). Although natural gas has supplanted tin and silver as the country's most valuable natural resource, Bolivia has had trouble establishing itself as the energy hub in South America. The country has also not been able to find a way to obtain potentially large gains from liquefying its natural gas and exporting it to such lucrative markets as the United States. Bolivia does not consume a significant amount of natural gas domestically, and the country has not succeeded in effectively reinvesting tax revenues from its natural gas exports to aid the country's wider economic development. Progress toward these potential objectives has not materialized because of a pipeline infrastructure designed to export natural gas only in crude form to Brazil and conflicts over the Bolivian Government's role in controlling mineral resources, including fuels (Economist, The, 2005; Federal Research Division, U.S. Library of Congress, 2005, p. 10-11).

Annually, only about one-fourth of the officially eligible labor force is employed formally in Bolivia. The officially eligible labor force totaled about 4 million employees in 2003, but figures that include estimates of the teens, children, and others employed put the actual labor force at closer to 5.5 million. For an example of how many unofficial workers may be employed in Bolivia's mining sector, the International Institute for Environment and Development estimated that about one-half of the approximate 8,000 artisanal miners in the Cerro Rico area of Potosi Department were children and adolescents. Officially in 2003, about 22,880 of the eligible workers were employed in mining and the exploitation of mineral resources, but estimates that still only include officially ineligible workers but also more part-time workers put the total number of official employees in the mining sector at about 50,000. Even this larger number includes only a fraction of the SMACA miners that are actually considered "employees" in Bolivia. As a group, SMACA miners were estimated to total about 72,000 in 2003 (Hentschel and others, 2003, p. 18, 19, 31, 33; Federal Research Division, U.S. Library of Congress, 2005, p. 9-12; Instituto Nacional de Estadística, 2005a, p. 271).

In the mineral fuels sector, official employment figures are more representative of the actual numbers of Bolivians working in the sector, although there are many foreigners involved in operating the export network of natural gas pipelines. In 2003, about 15,900 were employed in the production and distribution of electricity, natural gas, and water (of which a very small proportion were actually employed in the production of natural gas). Industrial manufacturing employed about 442,000 workers and was the third ranked sector for official employment in Bolivia following, in order of importance, agriculture and retail operations. The manufacturing sector included production of refined metals and refined petroleum as the fifth and sixth ranked manufactured goods, respectively, following, in decreasing order of the value of production, textiles, clothing, nondurable consumer goods, and processed soya. Agriculture, forestry, and fishing have traditionally been mostly responsible for domestic employment, and employed at least 44% of the official Bolivian labor force in 2004. Development of the manufacturing sector and advanced mineral processing capacity has lagged behind overall industrial production and the extraction of mineral raw materials in Bolivia owing to inadequate avenues to obtain necessary credit and competition for potential exports (Federal Research Division, U.S. Library of Congress, 2005, p. 9-12; Instituto Nacional de Estadística, 2005a, p. 271).

## Environmental Issues

Environmental nongovernmental organizations (NGOs) from all over the world are very active in Bolivia and often have many local members participating in demonstrations alongside small-scale miners and agricultural workers. Bolivia's major environmental NGOs include the Asociación Boliviana para el Medio Ambiente (Bolivian Association for the Environment), the Centro de Datos para la Conservación (Conservation Data Center), Centro Interdisciplinario de Estudios Comunitarios (Interdisciplinary Center for Community Studies), Conservación Internacional-Programa Bolivia, ENDA-Bolivia, Fundación Amigos de la Naturaleza (Friends of Nature Foundation), Liga de Defensa del Medio Ambiente (League for the Defense of the Environment), and the Protección del Medio Ambiente Tarija (Environmental Protection Group) (Yahoo! Inc., 2005§).

The major international agreements that Bolivia has signed include Biodiversity, Climate Change (including the Kyoto Protocol), Desertification, Endangered Species, Environmental Modification, Hazardous Wastes, Law of the Sea, Marine Dumping, Marine Life Conservation, Ozone Layer Protection, Nuclear Test Ban, Ship Pollution, Tropical Timber 83, Tropical Timber 94, and Wetlands (Yahoo! Inc., 2005§). In 2004, environmental standards in Bolivia were monitored by the Ministerio de Desarrollo Sostenible y Planificación (MDSP) at the national level and its Secretaría Departamental de Desarrollo Sostenible y Medio Ambiente at regional and departmental levels. Another Bolivian Government agency with oversight responsibility for environmental matters was the Viceministerio de Medio Ambiente, Recursos Naturales y Desarrollo Forestal.

NGOs were very active in attempting to keep large-scale mining activities out of many protected areas in Bolivia because Bolivian regulatory agencies have historically had trouble enforcing environmental regulations, especially in remote areas. SMACA miners have often welcomed the efforts of environmental NGOs to help keep large mining companies, especially foreign companies, out of mineral-rich areas to which the small-scale miners wish to have first access. In 2004, the Bolivian Government's Servicio Nacional de Áreas Protegidas (National Service for Protected Areas) managed 21 protected areas in Bolivia (Federal Research Division, U.S. Library of Congress, 2005, p. 7).

Many examples exist of breaches of environmental regulations that the Bolivian Government has not been able to enforce adequately. Sometimes these infractions involve foreign mining and exploration companies, but often they do not. A Canadian mining exploration and development company began exploration of a gold property near the Brazilian border with Brazil and 500 artisanal miners from both Bolivia and Brazil (garimpeiros) soon invaded the concession. These miners organized themselves into a cooperative and began exploiting the richest part of the deposit, and were estimated to have contaminated the surrounding environment with uncontrolled disposal of about 15 t/yr of mercury. The nearest Bolivian authorities were about 1 hour away by small plane and were unable to help the foreign firm enforce their claim to the concession or help enforce any environmental regulations. The firm had to make a private deal with the small-scale miners to limit the areas of the deposit that they were working and limit membership in the cooperative in return for technical assistance and employment by the firm if any significant medium-scale production were to begin. In 2004, the firm was still conducting exploratory drilling and the number of artisanal miners on the property was estimated to be down to 150 (Hentschel and others, 2003, p. 71).

Both foreign mining companies and domestic miners have experienced considerable difficulty with communities nearby that have accused them of polluting the surrounding lands and water supply, but the Bolivian Government's problem is usually one of enforcement, in general, not just enforcement of environmental regulations. A domestic cooperative that was doing fairly well at mining gold and even working toward environmental compliance, with the help of MEDMIN, lost its mine to local community activists who desired a large percentage of the proceeds from the mine. In 2004, these community residents were attempting to work the mine and reportedly causing far more pollution than the mining cooperative had, while recovering much less gold. Bolivian authorities were again unable to enforce either the cooperative's rights to the mining concession or any environmental regulations (Hentschel and others, 2003, p. 27).

Barring corruptive influences, bigger foreign mining companies are more susceptible to regulation and have greater access to more-modern environmentally friendly technologies than SMACA mining operations. In 2004, NGOs were pressing for more environmentally friendly technologies to be used in new medium-scale mining development projects by foreign-based companies at the Kori Chaca, San Bartolome, and San Cristobal Mines. In 2004, environmental legislation in Bolivia was oriented toward making sure that firms declare what environmentally hazardous materials were being used, what the hazardous content of any effluent was, and how the treatment of tailings and other waste was being carried out (McMahon and others, 1999, p. 19-22; Pauwels, 2005§).

## Exploration

The major mining investment projects expected to come onstream between 2005 and 2008, the major projects nearing more advanced stages of development, the project development budget as of 2004, and the owner with controlling interest, in order of decreasing development cost, were the San Cristobal Mine (silver, zinc, lead)—\$520 million (Apex Silver Mines Limited), San Bartolome Mine and Plant (silver-tin)—\$80 million (Coeur d'Alene Mines Corporation), Colas de Colquiri Mine (zinc-tin)—\$30 million (CMC), Kori Chaca Mine (gold)—\$20 million (Newmont Mining Corporation), and the Popoó Mine (zinc, lead, silver)—\$12 million (COMSUR). The most valuable of these projects, by far, was expected to be San Cristobal, which had been put on hold since early 2001 in anticipation of a recovery in the price of silver despite a favorable bankable feasibility study (Centro de Documentación e Información, Bolivia, 2004; Apex Silver Mines Limited, 2005, p. 6). In 2004, the owners of San Bartolome, which is located on the flanks of Cerro Rico near the city of Potosi, and San Cristobal were attempting to expand the extent of their proven and probable reserves beyond what had already been approved for development. For San Bartolome, reported reserves of silver remained the same as those reported in 2003 at about 3.8 t, but estimated reserves at San Cristobal were expanded slightly to 3.6 million metric tons (Mt) of zinc, 1.3 Mt of lead, and 14.5 t of silver compared with 3.4 Mt, 1.2 Mt, and 13.9 t, respectively, in 2003 (Wilburn, 2005).

By 2004, the mining cooperatives involved in both base-metal and gold production had become quite opposed to FDI in new mining projects by medium-scale firms, partly owing to past misunderstandings experienced in joint-ventures with foreign mining companies, especially with junior exploration and development firms that were interested in gold projects prior to the mid-1990s. Reportedly, many cooperatives contributed the exploration rights for the concessions but claimed to understand that the foreign companies would undertake the exploration and development (using more technologically advanced methods). Frequently, however, the junior firms were only interested in using the acquisition of some share of the concession to boost the price of their shares, while undertaking only minimal exploration to provide positive preliminary feedback to stockholders. In some cases, a junior firm would actually pursue rigorous exploration on the concession, after agreeing to a contract with the cooperative(s) to purchase or help sell the concession to another foreign mining company in the case of a significant strike, but the level of ore grade, etc., necessary for a modern, efficient

mining operation was not communicated very well to the small-scale miners involved in the joint venture. Almost none of these mining projects, including those interested in discovering quality deposits of base metals, ever went forward to become successful mining projects, and the large number of small-scale miners involved never fully understood the real reasons for this failure. In 2004, foreign mining companies were still unable to obtain the confidence of cooperatives for many types of joint-ventures concerning new exploration and development of mineral deposits in Bolivia (Hentschel and others, 2003, p. 72).

Most exploration was centered around areas where there was already substantial development, such as in the Potosi Department, or was targeted merely to expand an existing mine or extend the life of mines that were already in production. Average annual prices for most mineral commodities were higher in 2004 compared with 2003, and it is typical during periods of higher prices to focus exploration efforts in areas where there are already productive mines, functioning smelters, and adequate infrastructure to bring any new mine output to market before prices dip again (Wilburn, 2005). This was especially true in 2004 in Bolivia, where adequate infrastructure is lacking for much of the country and the risks of investing in new infrastructure are substantial (Barrau and others, 2004).

One example of this type of exploration was in the upper mineralized zone of the Don Mario Mine, which was already producing gold from its lower mineralized zone in 2004. Orvana did not report any expansion of reserves as a result of this drill program, however (Orvana Minerals Corporation, 2004, p. 3). Another example on a smaller scale in 2004 was the attempt by Golden Eagle International Inc. of Salt Lake City, Utah, to discover further reserves along the parts of the Ascension gold-copper trend to gain financing for its Buen Futuro claim and restore mine production of metals on its properties in the Tipuani Gold Mining District, which is located in the Precambrian Shield of eastern Bolivia. Golden Eagle had to halt production at its Cangalli prospect in the same district in June 2004 but estimated proven and probable reserves for a section of Buen Futuro to be about 2,600 kg of gold and 37,200 t of copper by the end of 2004 (Golden Eagle International Inc., 2005, p. 5-6, 20-23).

The iron ore deposit of El Mutun, which is located north of Puerto Suarez in the remote southeastern region of Bolivia, had been previously explored and even produced a small amount of iron ore in the 1960s. Commercial development of a mine there was deterred by a lack of infrastructure to transport or export any output, and it has been consistently difficult to attract foreign capital to the potential iron ore, direct-reduced iron (DRI), and steel production project. El Mutun is located within a national security zone close to the Brazilian border, and any further exploration or eventual commercial exploitation of the resource must be through a joint venture with COMIBOL. The state-run mining company had little success in reaching a satisfactory agreement with any foreign firm, but had been actively promoting El Mutun for this type of privatization since the mid-1980s. COMIBOL estimated that a mine at El Mutun would produce at least 1.5 million metric tons per year (Mt/yr) of iron content if the site were developed using modern technology. In 2004, COMIBOL attempted to improve its terms by promoting the availability of cheap Bolivian natural gas for the production of DRI, backing off slightly on its demands for immediate installation of a steel manufacturing plant, and allowing interested producers to ship raw ore and DRI down the Paraguay River to be exported directly. These new efforts attracted substantial new interest, including visits by representatives from the People's Republic of China and the Republic of Korea in 2004. Annually since the property was first made available, the most consistent bidders for the rights to explore and develop El Mutun have been Brazilian investors, who continued expressing interest in 2004. Even with high prices for ferrous metals in 2004, COMIBOL's latest terms did not appear to be sufficient to overcome the prohibitive costs of transporting the proposed mine output some 2000 miles before reaching the tidewaters of Puerto Suarez, especially when such development costs are adjusted for political risk and other risk considerations. This more recent exploration and development plan attracted more interest than earlier plans that were targeted toward attracting foreign investors to build infrastructure and transport the potential mine output into the Bolivian interior for further industrialization and steel manufacturing. While these older plans were lauded for their potential contribution to the economic development of the country, the eventual costs of bringing the end product to the markets of the expected consumers was too great for foreign investors. Some influential Members of Congress, however, were still interested in requiring COMIBOL to reject any joint venture bid until market conditions reach a point where a development plan that provides more value added to the Bolivian economy becomes feasible. In 2004, such market conditions were not present for Bolivia, because Argentina and Brazil already produced more iron and steel than they consumed, Bolivia and Paraguay consume very little iron or steel, and other potential markets that are closer to the interior of Bolivia (such as Chile) have not been considered as likely trading partners in ferrous mineral products for less economic reasons (Bolpress, 2005§; Gutiérrez, 2005§; Vasquez, 2005§).

In 2004, the numerous discoveries of natural gas in Bolivia included an exploratory well test of more than 1 million cubic meters of gas per day in October 2004 by Total Exploration & Production Bolivia (a subsidiary of Total S.A.) within Bolivia's Ipati block, which is located 300 km south of the city of Santa Cruz (Total S.A., 2004§). A joint venture between Chaco (90%) and Pan Andean Resources plc (10%) discovered the El Dorado gas deposit, which is located about 40 km south of the city of Santa Cruz (Pan Andean Resources plc, 2004§). In July 2004, Chaco also discovered another natural gas field in the Parcheles X1001 well, which is located 60 km southwest of the city of Santa Cruz and has reserves estimated to be 8.5 million cubic meters (Alexander's Gas & Oil Connections, 2004b§).

## **Production**

The value of mine production of metals and industrial minerals in Bolivia increased to about \$511.4 million in 2004, which was an increase of 25% compared with that of 2003 owing to the annual average increase of most mineral prices. Production levels of most of the important mineral commodities in Bolivia increased only slightly, if at all, during the same timeframe, however. In 2004, SMACA miners controlled a greater share of the quantity of mine production of metallic minerals than in 2003, which continued a trend away from medium-scale production since 1999 in Bolivia. These small-scale operations were quite sensitive to price increases during the year, but their ability to ramp up production rapidly in response to an increase in prices (as took place toward the end of

2003 and through 2004) appeared to be much less than their ability to decrease production (by temporarily abandoning the concession) as they have demonstrated during periods of lower prices. From 2000 to 2004, the share of small-scale mining enterprises responsible for Bolivian production of antimony increased to between 84% and 96% compared with between 35% and 42% in the late 1990s; SMACA miners accounted for 100% of the country's mine production of bismuth and tungsten, copper (84%), tin (63%), and gold (62%) in 2004. Medium-scale mining operations accounted for a majority the country's mine production of only zinc (75%), lead (54%), and silver (53%) in 2004 (Asociación Nacional de Mineros Medianos, 2005, p. 80-84).

In mine production levels, zinc has dominated the production of metals and industrial minerals in Bolivia for the past 10 years, and zinc production has consistently been mostly under the control of medium-scale firms. For 2004, a comparison of the annual production of zinc to tin production is useful in comparing the responsiveness of two sectors of the mineral industry that were controlled by medium-scale vs. small-scale mining entities. Tin production has never been majority-controlled by medium-scale firms during the past 10 years, but their minority share of Bolivia's mine production of tin decreased even further (by about 14%) in 2004 compared with that of 2003. This was mostly owing to small-scale miners occupying more of both the Caracoles and the Huanuni tin mines. It should be noted that the SMACA miners at both of these tin mines demonstrated actively for the Government to provide technological assistance for them to gain access to the lower regions of these mines. The annual average price of tin was slightly greater than 60% higher in 2004 than in 2003, while the price of zinc increased by about 27%. During the same timeframe, annual mine production of tin increased by only about 814 t, which was still far below the combined capacity listed for the Caracoles and the Huanuni Mines, while production of zinc increased by 921 t, although Bolivia's major zinc mines were already operating at near capacity. Bolivian mine production of antimony increased by about 7%, although its annual average price increased by 18% in 2004 compared with that of 2003. Production of tungsten actually decreased by 8.6%, although the price increased by about 29%, and both antimony and tungsten reserves remained basically unchanged during the same timeframe (Asociación Nacional de Mineros Medianos, 2004, p. 88; 2005, p. 27, 74).

With respect to industrial minerals in 2004, Bolivian mine production of ulexite (a boron mineral) decreased by about 38% compared with that of 2003, but it was still 68% higher than in 2002. Production of barite, however, increased by 212%, and production of quartz increased by 332% during the same timeframe. Production of natural gas increased by about 39% in 2004 compared with that of 2003, and production of crude petroleum increased by about 16% during the same timeframe. Thus, production of natural gas continued its annual pace of substantial increases in 2004, but Bolivia could certainly have produced and exported much more if FDI in the sector (including reinvestment in existing wells) had not decreased by about 46% in 2003 compared with that of 2002. The Government also decided to not approve agreements to liquefy and export natural gas to interested markets, such as Mexico and the United States, that had been in negotiations since at least 2000, because the trade route proposed by the (foreign-based) producing companies as being the most economically efficient required exporting through Chile (Economist, The, 2005; Instituto Nacional de Estadística, 2005c, p. 57).

A wide array of countries that possessed significant metallic mineral resources increased mine production of metals dramatically in 2004, taking advantage of higher prices. Bolivia, however, did not ramp up production, even for mineral commodities of which the country had a significant abundance. This delayed response was of special concern within the country for commodities that were already being produced, such as antimony and tin, but there was also concern that prospects for the mining of metals that were not being produced, such as iron ore and steel from El Mutun, had not been developed in time to take advantage of dramatically higher prices in 2004. The Government expected metal prices to remain high through 2005, however, and that mine production levels for the metals that Bolivia was already producing would increase significantly after some lags in production during 2004 (Vasquez, 2005§).

## Trade

In the past 50 years, mineral resources have dominated Bolivian exports, but agriculture, forestry, and fishing have been mostly responsible for domestic employment. Exports of Bolivia's mine production of minerals was estimated to account for about 31% of the value of the country's total exports in 2004, which still ranked it third behind agricultural products (led by exports of soya) and mineral fuels (dominated by exports of natural gas). The continuous exploitation of natural resources in Bolivia since colonial times has not led to industrialization, and Bolivia still exported mostly ores as opposed to more refined mineral products in 2004. Even the existing facilities to further process and refine ores were increasingly in disrepair, including the Vinto tin smelter, as contracts to secure sufficient FDI had not been obtained even to maintain these facilities, much less modernize them (Federal Research Division, U.S. Library of Congress, 2005, p. 9-12; Instituto Nacional de Estadística, 2005a, p. 271; Monahan, 2004§).

In terms of both volume and value, Bolivia's leading nonfuel mineral export commodity in 2004 was zinc ore and concentrate, of which about 31% of the total volume of zinc exports was shipped to Japan, 25% was shipped to countries in Western Europe (mostly to Belgium and Switzerland), and another 20% was shipped to the Republic of Korea. Bolivia's exports of tin (about two-thirds of all tin exports were tin metal) were close to those of zinc in terms of value but not in terms of volume. The leading customer for Bolivian tin metal exports was the United States, which imported 82% of the total volume of Bolivia's tin metal exports in 2004. The leading customers for Bolivia's exports of tin minerals and concentrates were Malaysia, which accounted for 64% of Bolivia's total tin mineral exports, and China, which purchased about 35% of the total. In terms of value (but not in terms of volume), the next most important metallic mineral export commodity in 2004 for Bolivia was silver (unrefined), which accounted for 20% of the total value of Bolivia's nonfuel mineral exports. The leading customer for Bolivian silver was Mexico, which purchased about 40% of Bolivia's total exports (Instituto Nacional de Estadística, 2005b, p. 35-37, 97-108).

Exports of natural gas accounted for about 28.4% of the total value of Bolivia's exports. Brazil was Bolivia's leading customer for natural gas by far and purchased 92% of the total value of Bolivia's exports. Argentina was the only other significant importer of Bolivian natural gas and accounted for the other 8% of the value of Bolivia's exports in 2004. In 2004, Brazil continued to be the



main hub of mineral fuel trading in South America. In October, Argentina signed an agreement with Bolivia to import about four times as much natural gas directly from Bolivia annually in 2005 through 2011 as it imported in 2004 (about 881 million cubic meters). The most important condition imposed by Bolivia on the new natural gas purchase agreement with Argentina was that Argentina could not reexport Bolivian natural gas to Chile. Also, the increase in natural gas exports to Argentina was to be exclusive of the amount agreed upon in September 2004 for export to Uruguay through Argentina. The Bolivian President also signed a letter of intent to restart negotiations with Peru to liquefy and export Bolivian natural gas through Peru, although the construction of the pipeline that would be necessary to accomplish this would require substantial FDI, and a pipeline to export through Chile already exists. The leading customers for Bolivian liquefied gas would supposedly be California, Chile, and Mexico, although the United States and Mexico had already signed agreements with other suppliers (including Indonesia) by 2004 rather than wait for an uncertain supply of Bolivian natural gas (Bridges, 2005; Instituto Nacional de Estadística, 2005b, p. 35-37, 97-108; Portal Minero, 2004c§; Rigzone.com, 2004b§).

In 2004, the value of Bolivia's mineral trade balance increased to more than \$1 billion compared with \$605 million in 2003. This was primarily driven by an increase in the country's trade surplus for mineral fuels, which was \$712 million in 2004 compared with \$382 million in 2003, but increases in the trade surpluses for metallic minerals (to \$287 million from \$221 million) and industrial minerals (to \$2.7 million from \$1.5 million) also contributed. In 2004, the total value of mineral imports increased to \$140 million compared with \$129 million in 2003, and mineral imports consisted mostly of combustible products and lubricants derived from mineral fuels (\$135 million in 2004 and \$123 million in 2003). In 2004, Bolivia incurred negative trade balances for the country's consumption of smelted and refined metals and their semimanufactures, except for lead and tin (\$266,000 and \$117 million trade surpluses, respectively). The trade deficit for pig iron and crude steel was \$92 million; semimanufactures of iron and steel, \$64 million; aluminum and its semimanufactures, \$14 million; refined copper, \$1.7 million; refined zinc, \$190,000; and refined nickel, \$23,000 (Instituto Nacional de Estadística, 2006, p. 32, 34, 100-101).

Bolivia's most important imports for its mineral industry are various types of mining equipment. Mining cooperatives obtain some alluvial gold mining equipment through imports, often together with the support of Bolivian Government agencies, but medium-scale mining companies account for most of the mining equipment imports, such as bulldozers, drills, compressors, conveyors, crushers, frontloaders, gravimetric or flotation concentrators, pumps, pulverizers, and trucks. SMACA miners are most likely to import, in decreasing order of likelihood, hand tools, explosives, small drills, trucks, concentration tables, front-loaders, crushers, and flotation concentrators. In 2004, the new medium-scale silver mining development projects in southern Potosi Department received most of the country's imports of mining equipment. With the recovery of mineral prices (especially those of gold, silver, and tin) in 2004, mining projects that had been put on hold renewed investment in imports of mining equipment during the year and expected to continue importing more through 2005 to bring production onstream before prices decrease (U.S. Commercial Service, 2004, p. 19).

Through 2004, Bolivia actively pursued better economic connections within South America, and the Government expressed hope that the country could become less dependent on the United States as a primary trading partner. In 2001, Brazil overtook the United States as Bolivia's primary export outlet mostly owing to completion of natural gas pipelines. The United States began negotiations for a Free Trade Agreement (FTA) with Colombia, Ecuador, and Peru in 2004. The proposed agreement was expected to be between the United States and all Andean nations, including Bolivia. The U.S. Trade Representative (USTR) did not visit Bolivia in 2004, however, and issued only an informal proposal that Bolivia could be included in the talks at some later stage. The USTR also expressed interest in working with Bolivia to improve Bolivia's chances for eventual inclusion in the agreement during the interim, but no official meetings appeared to be scheduled. In 2004, trade between Bolivia and the United States was still conducted under the Andean Trade Preference Act, which was due to expire in 2006 (U.S. Commercial Service, 2004, p. 2; Instituto Nacional de Estadística, 2005b, p. 35-37, 97-108; U.S. Trade Representative, 2004§).

## Commodity Review

### *Metals*

**Antimony.**—EMUSA was the only medium-scale operation to produce antimony in Bolivia in 2004, and it produced only 485 t of antimony in concentrate. EMUSA controls the antimony production out of the Caracota, the Chilcobija, and the Espíritu Santo Mines, but apparently only the Caracota and the Espíritu Santo Mines contributed to production in 2004. As reported by EMUSA, the Chilcobija Mine had a listed capacity of about 5,000 t/yr of antimony until it was temporarily placed on care and maintenance in 1999 because of low antimony prices. The lack of mine production during a period of very high prices in 2004, however, and because EMUSA increased antimony production by only 159 t compared with the company's level of production in 2003, may indicate that Chilcobija is basically depleted and that the two other mines may contain only lower grades of antimony. Prior to 1999, the antimony ore produced out of these three mines was generally of a much higher quality than what was produced in China and Russia, and Chilcobija Mine was the leading producer of antimony in South America (Asociación Nacional de Mineros Medianos, 2005, p. 18-19, 25-29, 80).

In 2004, the Vinto antimony smelter reportedly produced 50 t of antimony metal. Most of the 2,633 t of antimony that was mined by SMACA miners in the country was exported for smelting even as far away as China. The antimony circuit of the Vinto smelting complex was owned by CMC (Asociación Nacional de Mineros Medianos, 2005, p. 19).

**Copper.**—EMUSA appeared to begin producing copper in 2003, but 2004 actually brought a relative decrease in production for the company as SMACA miners occupied most of the recently discovered deposits. From 1989 until 2002, small-scale mining operations and cooperatives were responsible for all the mine production of copper in Bolivia, but their reported production decreased to a total of 18 t during 2001. In 2002, SMACA miners produced only 3 t of fine copper, but EMUSA reported producing 146 t of fine copper

from an undisclosed mining location. In 2004, SMACA miners increased their annual production to 502 t compared with 13 t in 2003, and EMUSA was responsible for the remainder of mine production of copper (table 1; Asociación Nacional de Mineros Medianos, 2005, p. 18, 81).

**Gold.**—The Kori Kollo open pit was flooded with waters of the Desaguadero River in 2004, but Newmont approved the Inti Raymi's plans to continue recovering residual gold through the reclamation process of the Kori Kollo tailings dam facility, waste dumps, and other facilities through 2008. In October, 2003, Newmont had announced that it would divest itself of its Bolivian properties in 2004, but the U.S. company decided to maintain its presence in the country after the price of gold increased. In 2004, about 675 kg of gold was produced (reclaimed) at Kori Kollo, and Newmont authorized further exploration in the near vicinity during the year. Construction of the neighboring Kori Chaca open pit began in 2004, and Newmont expected the combined operations of processing oxide ore from Kori Chaca and reprocessing high-grade tailings from Kori Kollo on a new leach pad to produce about 2,600 kg of gold in 2005. Reserves at Kori Chaca were estimated to be about 9.3 t of gold content, but the average grade of the ore was estimated to be only 0.8 grams of gold per metric ton of ore (Newmont Mining Corporation, 2005, p. 19, 38, 40, 71).

Orvana Minerals reported about 1,500 kg of mine production of gold during the first full fiscal year of operation that ended in September 2004 from 126,200 t of underground ore and 108,000 t of open pit ore treated at the mill onsite at its wholly owned Don Mario Mine. The operator of the mine (Empresa Minera Paititi) worked closely with COMSUR (the controlling shareholder in Orvana in 2004) to develop the project. Shaft installation and underground development at the mine proceeded in 2004, and Orvana reported that the ore grade of gold increased from July through September. The grade of copper also increased during the year, however, which negatively affected Minera Paititi's ability to leach the gold. Technological improvements to improve elimination of copper were underway toward the end of 2004, but about the same annual level of production of gold was expected for fiscal year 2005 (Orvana Minerals Corporation, 2004, p. 1-9).

In 2003, Golden Eagle had its first full year of gold production out of its wholly owned Cangalli Mine in the company's Tipuani-Cangalli prospect, which is located about 100 km north of the city of La Paz. The company had to shut down the mine in June 2004, however, owing to a local farmer's strike that blocked access to the mine and legal disputes that involved the local mining cooperative United Cangalli Gold Mining Cooperative Ltd. and FENCOMIN. United Cangalli sold the claim to the Cangalli property to Golden Eagle in 2002. During the first half of 2004, the company produced about 64 kg of gold at the Cangalli Mine but could not guarantee whether they would be able to restart production once United Cangalli, which supplied some workers to work the mine and leased a shaft to work part of the mine independently, resolved its legal difficulties. By the end of 2004, Golden Eagle had not obtained the necessary environmental permits to continue development of the Buen Futuro property, which is located 245 km north of the city of Santa Cruz (Golden Eagle International Inc., 2005, p. 5-6, 8).

**Lead and Zinc.**—In 2004, COMSUR and CMC combined to produce about 70.5% of Bolivia's total mine output of zinc at five mines in the Departments of Oruro and Potosi. COMSUR's share of production at these and other mines also accounted for about 48% of the lead produced in 2004 in Bolivia. COMSUR's share of Bolivian production capacity amounted to about 225,000 t/yr of zinc and 13,000 t/yr of lead. The sale of COMSUR to Glencore at the end of the year was reported to have included a sulfuric acid plant, but data concerning the production capacity of the plant or the amount of sulfur produced in 2004 was not made publicly available by the company. In 2004, Bolivian zinc production was about the same as in 2003, mostly owing to mines wholly or partially owned by COMSUR still producing at only a fraction of their capacity because zinc was among the most sluggish of the base metals to increase in monthly average price during this timeframe. Additionally, COMSUR underwent substantial restructuring before and after being acquired and did not necessarily have the personnel in place to expand zinc production as prices finally increased significantly during the last quarter of 2004 (Asociación Nacional de Mineros Medianos, 2005, p. 18; Glencore International AG, 2005§).

On average over an expected mine life of 16 years, Apex (a U.S. company incorporated in the Cayman Islands) expected to produce about 167,500 t/yr of zinc and 63,500 t/yr of lead at its wholly owned San Cristobal Mine in the Department of Potosi and to begin production in the second half of 2007 (Apex Silver Mines Limited, 2005, p. 2, 22). Once it is producing at expected capacity, the San Cristobal operation was expected to employ about 1,000 people directly and about 4,000 indirectly (Centro de Documentación e Información, Bolivia, 2004). The employment figures associated with the San Cristobal project may also either substantially exceed expectations or fall quite substantially below them, depending on whether the ore from the mine is actually going to be exported through a port in Chile to be smelted and refined abroad or whether it will be smelted domestically at the nearby Karachipampa smelter.

The Karachipampa smelter, which was designed and built by German and Belgian engineers to process the ore expected out of San Cristobal in 1984, has fallen somewhat into disrepair since then. In 2004, plans to start up Karachipampa included construction of a modern zinc refinery to replace part of the smelter's original design, which was intended to eliminate only small quantities of zinc in the ore as an oxide and to store it as waste. (Karachipampa was built to smelt over 51,000 t/yr of concentrates containing mostly silver and lead.) Modernization of the smelter was not part of Apex's development plan in 2004 for San Cristobal, and Apex intended simply to export the unprocessed ore by rail through Chile. After the company made some progress in developing San Cristobal and as the prices of all the metals involved (including the price of zinc) increased substantially by the end of 2004, COMIBOL was able to attract interest from at least five foreign investors (other than Apex) in a joint-venture modernization project for Karachipampa. Exporting ore through Chile would likely be politically problematic for Apex because Bolivia's economic and political relationship with Chile has remained contentious since Bolivia lost its access to the ocean as the result of the War of the Pacific with Chile from 1879 to 1880 (Apex Silver Mines Limited, 2005, p. 7; Federal Research Division, U.S. Library of Congress, 2005, p. 3; Amcham Bolivia, 2005§; Los Tiempos, 2005§).

**Silver.**—In 2004, production attributable to COMSUR's share in mines that produced silver accounted for about 48% of all of the silver produced in Bolivia, and SMACA miners accounted for about 47%. The remaining 5% was mostly mined by EMUSA, and

only about 4 t was produced as a byproduct of zinc mining by La Solución and as part of the doré recovered by Inti Raymi at the Kori Kollo processing facilities (Asociación Nacional de Mineros Medianos, 2005, p. 18, 82). In 2004, the expected development of the San Cristobal and San Bartolome Mines will be in the Department of Potosí, but about 55 mining cooperatives are also listed in the region. As part of the 2004 mining reactivation plan, the Government expected Apex Silver Mines and Coeur d'Alene Mines Corporation (based in Coeur d'Alene, Idaho) to contribute a combined \$7 million per year in economic assistance for some of these cooperatives once commercial production begins at these mines. Such local profit sharing will be an ongoing concern for foreign investors. In addition, about 300 SMACA miners were expected to be employed directly in the San Bartolome Mine and an additional 800 people were expected to be indirectly employed in other company operations in the area, such as a Coeur d'Alene company foundation to assist the regional Government of Potosí in establishing a silversmith and other industrial and metal processing capacity. The new cottage industry is expected to manufacture ornaments, jewelry, and silverware from metal extracted at the San Bartolome Mine (Centro de Documentación e Información, Bolivia, 2004; Monahan, 2004§; Amcham Bolivia, 2005§; Kosich, 2005§).

Coeur d'Alene expected its San Bartolome Mine to start producing about 187 t/yr of silver beginning in the latter half of 2006. The silver production capacity at the mine is expected to be about 250 t/yr after 2007, and the initial mine life was estimated to be about 14 years in 2004. The San Bartolome Mine will also produce an unspecified amount of tin. The mine is to be operated by Coeur d'Alene's wholly owned Bolivian subsidiary Compañía Minera Manquiri S.A. The company's rights to the San Bartolome property are held through long-term joint-venture and lease agreements with several local independent mining cooperatives and COMIBOL. Any eventual production from San Bartolome Mine is reportedly subject to a royalty of 4% that is payable to the cooperatives and COMIBOL, although it is unclear whether it is 4% to each partner or 4% to be divided among all of Coeur d'Alene's partners in the San Bartolome project (Coeur d'Alene Mines Corporation, 2005, p. 16-17, F-20). Apex expected to produce an average of 530 t/yr of silver during the expected life of the San Cristobal Mine (Apex Silver Mines Limited, 2005, p. 2). Starting in 2008, the combined fiscal impact of the two projects on the Bolivian economy is expected to amount to about \$17 million per year in tax revenue to the Bolivian National Treasury plus \$11 million per year in royalties payable to COMIBOL (Amcham Bolivia, 2005§).

**Tin.**—In 2004, COMSUR's share of Bolivian capacity to produce tin metal at the Vinto smelter (through ownership by CMC) amounted to about 12,000 t/yr. COMIBOL claimed that the Huanuni tin mine required greater foreign investment to improve its efficiency and that the Vinto tin smelter was in disrepair. COMSUR countered that the smelter was operating normally, but that production was down owing to a lack of feed from the nearby Huanuni and Caracoles Mines. These mines were occupied and operated by SMACA miners in 2004, but Huanuni Mine has historically supplied about 70 percent of the tin processed by the Vinto smelter. COMIBOL controlled both mines and directly designated some parts of them for operation by interested mining cooperatives in 2004. With respect to the Huanuni Mine, which is located in the Department of Oruro, COMIBOL took over the administration and direction of the officially listed mine operator, Empresa Minera Huanuni S.A., in 2002, but has had repeated conflicts with SMACA miners, who have demanded access to the richer, deeper parts of the mine but cannot mine at that depth as efficiently as modern medium-scale mining companies. Empresa Minera Caracoles S.A. was in charge of operating the Caracoles tin mine, which was also administered by COMIBOL and is located in the Department of La Paz. In 2004, additional tin metal may have been produced at Fundestano de Oruro S.A. or at Empresa Minera Hermanos Bernal S.A., but detailed information concerning the operations of these smelters was not publicly available (Asociación Nacional de Mineros Medianos, 2004, p. 21, 76).

**Tungsten.**—Tungsten was mined in Bolivia only by SMACA miners. Most of the mines were in the Department of La Paz in eastern Bolivia. Bolsa Negra Mine was owned by COMIBOL and operated by a cooperative. The major artisanal mines were the Chambilaya, the Chicote Grande, the Chojilla, the Enramada, the Kami, the Mercedes, the San Antonio, the Reconquistada, and the Ucumarini Mines (Montes de Oca, 2005§). Bolivia was estimated to contain about 53,000 t of tungsten reserves, which was less than 2% of global reserves. Because the People's Republic of China holds about 62% of the world's reserves of tungsten, medium-scale exploitation of tungsten in Bolivia has proven to be too risky of an investment and was expected to continue to be so into the foreseeable future (Bonel and Chapman, 2005, p. 289-290).

### ***Industrial Minerals***

**Ulexite.**—On June 23, 2004, the Bolivian Government expropriated the only major ulexite mining concession from Non Metallic Minerals S.A., which was a subsidiary of the Chilean borates producer Química e Industrial del Bórax Limitada. The company had been mining ulexite in the Salar de Uyuni in the southern part of the Department of Potosí, where it owned about 10 concessions. The MMM reported that the Chilean company had been avoiding appropriate taxation by withholding information concerning its exports of ulexite. The Bolivian Government was expected to begin a bidding process to award the concessions to other investors. Nearby Bolivian ulexite mining concessions owned by COPLA Ltda. and Rio Tinto Zinc plc were not affected. Tierra S.A. also mined ulexite in the Salar de Uyuni in 2004, but its owner was arrested for drug trafficking (illegally importing 3,500 t of sulfuric acid to be allegedly used for cocaine manufacture) in 2001 and production of ulexite was temporarily halted at that time. Production by the former employees of Tierra continued through 2004 (Industrial Minerals, 2004).

### ***Mineral Fuels***

The Bolivian oil and gas industry was dominated by most of the world's major energy companies: BG Group, BP, Exxon Mobil Corp., Petrobrás, Repsol, Royal Dutch Shell plc, and Total S.A., who unanimously denounced the progress that the Bolivian Government made during 2004 toward rejecting the President's hydrocarbons taxation bill in favor of a law that would in effect impose at least a 50% royalty on production of natural gas. In September, the Bolivian President had to draft the new bill, which would mandate the effective nationalization of the exploration and production companies Empresa Petrolera Andina S.A. and Chaco

and the export pipeline transport company Transredes S.A. because of congressional pressure and a lack of support for the old bill. FDI in the mineral fuels sector had already decreased by about 46.5% in 2003 compared with that of 2002 owing to political uncertainty surrounding the new hydrocarbons bill, and the above companies reported that their investment figures for Bolivia were even lower in 2004. A new investor, ShengLi Petroleum Group Corporation (a subsidiary of the Chinese oil company China Petroleum and Chemical Corporation), delayed actually signing any contracts with YPFB until a new hydrocarbons bill is passed, although the company did tentatively agree in September 2004 to initially invest \$150 million in exploration, production, refining, commercialization, and industrialization of mineral fuels in Bolivia (Instituto Nacional de Estadística, 2005a, p. 601, Alexander's Gas & Oil Connections, 2004a§; Portal Minero, 2004d§; Rigzone.com, 2004a§).

The natural gas industry appeared as if it would remain primarily oriented towards exporting natural gas to Bolivia's nearest neighbors, excluding Chile. Brazil was Bolivia's leading customer and Brazilian demands to lower the amount of Bolivian gas coming into the country may be somewhat temporary if Brazil can proceed rapidly in converting or building powerplants that will burn Bolivian gas. In April 2004, just such a powerplant was expected to begin consumption of Bolivian gas in 2009, although this was before replacement of the President's original hydrocarbons bill with the newer version (Portal Minero, 2004a§). In 2004, Pan Andean owned a 10% stake in the gas discovery at El Dorado, and the company and its partners in the venture focused on a liquefied natural gas (LNG) project aimed at transporting gas by tanker to the Mexico and the California markets. This was because of a lack of access to the pipelines that export gas to Brazil and Argentina, coupled with a lack of demand for more gas in Brazil. Also the company had low expectations for progress in the Government's plan to increase domestic Bolivian consumption for the natural gas liquids that Pan Andean expected to produce. Well into 2005, the only real alternative for the potential output from the two wells at El Dorado was for it to remain in the ground (Pan Andean Resources plc, 2005§).

## Outlook

Foreign investors revived some of their interests in the mineral industry of Bolivia owing to higher prices for many mineral commodities and Bolivia's estimated wealth of untapped mineral resources. The most significant new development projects during the year were more properly classified as restarts that had languished in a semiproductive or nonproductive state for the past 10 to 20 (or more) years after the exploration and early development stages had already been completed. Estimates of extensive unexplored and undeveloped mineral wealth in Bolivia will probably continue to attract some foreign investment to truly new mineral exploration projects and restarts. Ongoing political instability, uncertainty concerning the Mining and Hydrocarbons Laws, Government proposals for renationalization of both the mining and mineral fuels sectors, and the problems that the Government repeatedly has had with enforcing the policies that do exist (especially in more-remote areas) are likely to continue to deter many investments that would otherwise have proceeded at the price levels experienced at the end of 2004. If a new hydrocarbons bill is passed that implies effective nationalization of the mineral fuels sector, foreign firms interested in other sectors, including mining, will be reacquainted with the degree of risk inherent in FDI in the Bolivian economy.

Bolivia had widespread poverty, and the new mining reactivation plan could stimulate the development of an important sector of the Bolivian economy, although it may initially appear overly burdensome on foreign companies attempting to develop new mining projects. The plan requires foreign firms engaging in large lucrative mining and mineral projects to be more directly responsible for economic development at a micro level in the areas surrounding those projects. This could help circumvent taxation and redistribution schemes that have attempted to accomplish a similar goal but in which large portions of the expected tax revenue have not been collected or redistributed at the grassroots level. Immediately following 2004, continued high prices for minerals and Bolivia's expected mineral development potential may mean that even a fairly burdensome plan can be implemented without deterring the major mineral investments that were planned for the country's mineral industry, mostly with respect to the production of iron ore, natural gas, and silver.

According to the 2004 mining investment survey by the Fraser Institute, Bolivia ranked 61 out of 64 countries and jurisdictions in terms of overall appeal as a location for investment in mineral exploration and development and last among Latin American countries included in the survey. Important concerns cited in the Institute's analysis of the survey results were the uncertainty concerning changes in Government regulations (Mining Laws and Hydrocarbon Laws); uncertainty about the legality and enforceability of mining claims on native lands against domestic interests, such as mining cooperatives; and uncertainties concerning the taxation regime, labor regulations, and political stability. Based on the results of this survey, any additional burdens of the types laid out in the new mining reactivation plan for the mineral industry of Bolivia could become prohibitive and drive these companies to invest in other mining projects with comparable geologic potential if those alternative locations exist in countries or jurisdictions that rank higher in these areas of concern (Asociación Nacional de Mineros Medianos, 2005, p. 22; McMahon and Lymer, 2005, p. 6, 31, 33).

The data suggest that it was difficult for existing Bolivian mining enterprises to ramp up production to reap a substantial economic benefit for themselves and the Bolivian economy without additional FDI flows during a period of elevated mineral prices. If the mining reactivation plan does succeed in its primary goal of doubling the value of exports of the mining sector by 2007, similar to how the Hydrocarbons Law of 1996 resulted in booming exports of natural gas through 2004, then it may suffer from the same criticisms of the revenues not being adequately redistributed to benefit the average Bolivian economically and the mining sector may come under similar pressure for renationalization (Portal Minero, 2005§). In 2004, the new mining rehabilitation plan was approved by the Government and reportedly involves transferring more revenue directly from the foreign mining companies' expected profits to economic development of nearby Bolivian communities. The plan appears designed, however, also to impose higher taxes (royalties) on foreign mining firms' profits and still direct most of the tax revenue through Government channels. In 2004, the Bolivian Congress was able to reject a hydrocarbons bill that did not include a more formal nationalization of the mineral fuels sector, primarily because taxation of foreign private companies provided far less revenue than expected when the 1996 hydrocarbons law was passed. During

the hydrocarbons debate, members of Congress successfully associated lax enforcement of tax laws in that sector with a lack of Governmental control of the sector. The same argument was made regarding enforcement of the provisions of the new mining reactivation plan, although it was eventually approved by the Bolivian Congress.

At the end of 2004, nationalization of the entire mineral industry continued to have popular support in Bolivia. Royalties on the production of mineral fuels and mine production and other tax revenue from private industry were not perceived by Bolivians to have contributed to much perceptible economic development in the country. Bolivia had four presidents in the 3 years leading up to 2005, and effective management of the country's mineral and other natural resources was a leading issue in each election. If the latest policies to improve the mineral industry's contribution to economic development in the country are not more successful than in the past, then they are not likely to placate the growing public sentiment for renationalization of the mineral industry of Bolivia.

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## Major Sources of Information

Asociación Nacional de Mineros Medianos (ANMM)  
 Calle Pedro Salazar No. 600  
 Casilla 6190  
 La Paz, Bolivia  
 Telephone: (591-2) 417522

Instituto Nacional de Estadística - Bolivia (INE)  
 Calle José Carrasco N° 1391  
 Casilla Postal 6129  
 La Paz, Bolivia  
 Telephone: (591-2) 2222333  
 Internet: <http://www.ine.gov.bo>

TABLE 1  
BOLIVIA: PRODUCTION OF MINERAL COMMODITIES<sup>1</sup>

(Metric tons unless otherwise specified)

| Commodity <sup>2</sup>                                      | 2000             | 2001               | 2002               | 2003                   | 2004                |
|---|------------------|--------------------|--------------------|------------------------|---------------------|
| <b>METALS<sup>3</sup></b>                                   |                  |                    |                    |                        |                     |
| <b>Antimony:</b>  |                  |                    |                    |                        |                     |
| Mine output, Sb content                                     | 1,907            | 2,264              | 2,336              | 2,911                  | 3,118               |
| Metal, including Sb content of trioxide                     | 1,285            | 1,992              | 195                | 1,399                  | 808                 |
| Arsenic, mine output, arsenic trioxide, arsenic sulfide     | 318              | 846                | 237                | 276                    | 168                 |
| <b>Bismuth:</b>   |                  |                    |                    |                        |                     |
| Mine output, Bi content                                     | 6                | 8                  | 20                 | 72                     | 62                  |
| Metal, smelter  | 14               | 66                 | 88                 | 88 <sup>e</sup>        | 33                  |
| <b>Copper:</b>  |                  |                    |                    |                        |                     |
| Mine output, Cu content                                     | 110              | 18                 | 149 <sup>r</sup>   | 182                    | 596                 |
| Metal, smelter, primary                                     | --               | --                 | --                 | --                     | 441                 |
| Gold, mine output, Au content <sup>4</sup> kilograms        | 12,001           | 12,395             | 11,256             | 9,362                  | 6,951               |
| <b>Lead:</b>  |                  |                    |                    |                        |                     |
| Mine output, Pb content                                     | 9,523            | 8,857              | 9,893              | 9,740                  | 10,267              |
| Metal, smelter, primary kilograms                           | 251              | 106                | 947                | 947                    | 539,225             |
| <b>Silver:</b>  |                  |                    |                    |                        |                     |
| Mine output, Ag content kilograms                           | 433,592          | 411,000            | 450,311            | 465,309                | 406,957             |
| Refined <sup>5</sup> do.                                    | 55,720           | 32,603             | 31,871             | 32,000 <sup>r, e</sup> | 30,000 <sup>e</sup> |
| Tantalum, tantalite do.                                     | 9,443            | 11,992             | 10,823             | 10,070                 | 10,000 <sup>e</sup> |
| <b>Tin:</b>   |                  |                    |                    |                        |                     |
| Mine output, Sn content                                     | 12,464           | 12,352             | 15,242             | 16,755                 | 17,569              |
| Metal, smelter  | 9,353            | 11,292             | 10,976             | 11,000                 | 13,627              |
| Alloys  | 217              | 139                | 257                | 257                    | 86 <sup>e</sup>     |
| Tungsten, mine output, W content                            | 393 <sup>r</sup> | 532 <sup>r</sup>   | 399 <sup>r</sup>   | 441 <sup>r</sup>       | 403                 |
| Zinc, mine output, Zn content                               | 149,134          | 145,306            | 141,558            | 144,985                | 145,906             |
| <b>INDUSTRIAL MINERALS</b>                                  |                  |                    |                    |                        |                     |
| Amethyst (gemstones, rough) kilograms                       | 320              | 65                 | --                 | 144                    | 200                 |
| Barite  | 3,050            | 6,253              | 15,556             | 1,851                  | 5,774               |
| Bentonite   | --               | 159                | 216                | 227                    | 548                 |
| Cement, hydraulic thousand metric tons                      | 1,072            | 983                | 1,010              | 1,138                  | 1,276 <sup>p</sup>  |
| Marble  | 673              | 374                | 374                | 281                    | 327                 |
| Quartz kilograms  | --               | 7                  | 3                  | 11,422                 | 49,323              |
| Salt  | 732              | 308                | 3,834              | 2,271                  | 869                 |
| Slate, pizarra  | 269              | 246                | 306                | 228                    | 314                 |
| Ulexite   | 43,289           | 32,477             | 40,479             | 109,545                | 68,031              |
| <b>MINERAL FUELS AND RELATED MATERIALS</b>                  |                  |                    |                    |                        |                     |
| <b>Gas, natural:</b>  |                  |                    |                    |                        |                     |
| Gross million cubic meters                                  | 5,703            | 7,155              | 8,901              | 10,202                 | 12,673 <sup>p</sup> |
| Marketable do.  | 3,598            | 5,275              | 6,421              | 7,398                  | 10,257 <sup>p</sup> |
| Natural gas liquids <sup>e</sup> thousand 42-gallon barrels | 3,300            | 3,800              | 3,900              | 4,100                  | 4,500               |
| <b>Petroleum:</b>   |                  |                    |                    |                        |                     |
| Crude do.   | 10,107           | 11,424             | 11,338             | 12,223                 | 14,192 <sup>p</sup> |
| <b>Refinery products:</b>                                   |                  |                    |                    |                        |                     |
| Liquefied petroleum gas do.                                 | 528              | 528                | 612                | 695                    | 791 <sup>p</sup>    |
| <b>Gasoline:</b>  |                  |                    |                    |                        |                     |
| Aviation do.  | 26               | 25                 | 16                 | 21                     | 23                  |
| Motor do.   | 3,853            | 3,439              | 3,449              | 3,450 <sup>p</sup>     | 3,867 <sup>p</sup>  |
| Jet fuel do.  | 945              | 854                | 909                | 944                    | 946 <sup>p</sup>    |
| Kerosene do.  | 221              | 156                | 162                | 166                    | 150 <sup>p</sup>    |
| Distillate fuel oil do.                                     | 2,738            | 2,955 <sup>r</sup> | 3,198 <sup>r</sup> | 3,488 <sup>r, p</sup>  | 4,419 <sup>p</sup>  |
| <b>Lubricants:</b>  |                  |                    |                    |                        |                     |
| Oil, automotive do.   | 37               | 53                 | 61                 | 62 <sup>p</sup>        | 78 <sup>p</sup>     |
| Oil, industrial do.   | 2                | 2                  | 2                  | 2 <sup>p</sup>         | 5 <sup>p</sup>      |
| Greases <sup>6</sup> do.                                    | 1                | 2                  | 2                  | 2 <sup>p</sup>         | 3 <sup>p</sup>      |
| Asphalt <sup>6</sup> do.                                    | 9                | 12                 | 13                 | 13 <sup>p</sup>        | 14 <sup>p</sup>     |
| Paraffin oil <sup>6</sup> do.                               | 2                | 6                  | 6                  | 6 <sup>p</sup>         | 5 <sup>p</sup>      |

See footnotes at end of table.

TABLE 1--Continued  
BOLIVIA: PRODUCTION OF MINERAL COMMODITIES<sup>1</sup>

(Metric tons unless otherwise specified)

| Commodity <sup>2</sup>                         | 2000                       | 2001               | 2002               | 2003               | 2004                  |                     |
|--|----------------------------|--------------------|--------------------|--------------------|-----------------------|---------------------|
| MINERAL FUELS AND RELATED MATERIALS--Continued |                            |                    |                    |                    |                       |                     |
| Petroleum--Continued:                          |                            |                    |                    |                    |                       |                     |
| Refinery products--Continued:                  |                            |                    |                    |                    |                       |                     |
| Other <sup>e</sup>                             | thousand 42-gallon barrels | 8 <sup>r</sup>     | 5 <sup>r</sup>     | 28 <sup>r</sup>    | -- <sup>r, p</sup>    | -- <sup>p</sup>     |
| Total  | do.                        | 8,370 <sup>r</sup> | 8,037 <sup>r</sup> | 8,458 <sup>r</sup> | 8,849 <sup>r, p</sup> | 10,301 <sup>p</sup> |

<sup>e</sup>Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. <sup>p</sup>Preliminary. <sup>r</sup>Revised. -- Zero.

<sup>1</sup>Table includes data available through January 2006.

<sup>2</sup>In addition to the commodities listed, a variety of industrial minerals (clays, crushed and broken stone, dimension stone, and sand and gravel) are produced but available information is inadequate to make reliable estimates of output levels.

<sup>3</sup>Unless otherwise specified, data represent actual production by Corporación Minera de Bolivia and small- and medium-scale mines.

<sup>4</sup>Includes production of metallic gold.

<sup>5</sup>Includes production of metallic silver.

<sup>6</sup>Reported figures were converted from metric tons to equivalent barrels.